How Can Experimenters Help Improve Accelerator Operations?

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Outline

- What experimenters have been doing
  - A number of examples in BD
  - CDF and D0 as Tevatron diagnostics
- Some examples of new projects
- Intangibles
  - Why should experimenters help?
  - What it takes for a successful collaboration
- Summary

Some Past and Present Examples I

- Tev alignment – roll measurements
  - Roll fixture – Hans Jostlein, 2 teams of post-docs took measurements in current shutdown
- MI damper boards - Bill Ashmanskas, Eric James
- Existing Tevatron BPMs – Fritz Dejongh
  - Worked with technician to tune up performance and get correct electrical and survey offsets
  - Now getting useful data with coalesced beam
    - Conventional wisdom said system was useless for coalesced beam
- MARS code to simulate production, focusing, transport of Pbars – Peter Bussey
- Recycler flying wires – Peter Wilson
- MiniBoone and NUMI – people and money

MiniBoone and the Booster

- Projects
  - Loss studies
  - Resonant extraction of halo
  - Ramp monitoring code
  - MARS and neutron transport code code
  - TLM construction
  - Booster Studies
  - Dipole correction electronics and code
- Times
  - Minimum – 1 month
  - Maximum - 50% for 3 years
- Undergrads, grad students, post docs, professors
  - Columbia, Cincinnati, LANL, New Mexico, LSU, Michigan

MINOS collaborators involved in Proton Source activities

From Alberto Marchionni

- Caltech
  - Doug Michael, member of the **Proton Committee** chaired by D. Finley
  - Rich Smith (post doc) **large aperture Booster RF cavities**
  - Hai Zheng (post doc) **Main Injector RF barrier cavity, fast stacking schemes**
- University of South Carolina
  - S. Mishra (Main Injector Department, on leave of absence from USC), Andrew Godley (postdoc), Karen Wu (graduate student) **Main Injector/NuMI Beam Permit**
- Stanford University
  - Hyejoo Kang (post doc) **Main Injector dampers**
- University of Texas-Austin
  - Bob Zwaska (graduate student) **Booster notch cogging**

Some Past and Present Examples - II

- SDA – system for acquiring, archiving, analyzing data from stores
  - Allows correlation of information from multiple sources at specific times during the stores
  - Day to day monitoring of stores, long term trends
  - Specialized studies
    - Investigate correlations like luminosity vs. emittances, number of protons and anti-protons
    - Accelerator physics questions like pbar burn rate / total loss rate during HEP
- Analysis work so far has been done mostly by non-BD people
  - CD people led by Paul Lebrun
  - Students from BU, Texas Tech
  - JC Yun (CDF), Juan Estrada(D0)

Some Past and Present Examples - III

- Tev and MI emittance instrumentation
  - Woefully neglected
  - Early volunteers on hardware
    - flying wires - Stephen Pordes
    - Sync light - Harry Cheung
    - Sampled bunch display – Alvin Tollestrup
  - Offline (SDA) analysis – cross calibration of instruments
    - Example – compare emittance as measured by FWs with that measured by sync light, look for saturation effects
    - Started by students from BU and Texas Tech
    - Continued with people from Computing Division
  - Detected hardware problems and underlined problems with understanding Tev lattice

D0 and CDF as Tevatron Diagnostics

- Luminosity measurements
  - Bottom line of Tevatron performance
  - Cross check with accelerator measurements
  - Systematic difference CDF/D0 – soon resolved….
- Position and angle of beam from silicon vertex detectors
- Measurements of size of luminous region as a function of z,
  - Beta*, Emittances, Z of interaction point
  - Tev people would like this online every 15 minutes
  - Offline work "proceeds"

Some ideas for Collaboration I

- Instrumentation
  - Correlate beam positions at D0 and CDF as measured by collision point monitors with that reported by silicon vertex detectors – needs hardware investigation
  - Photodiode to use sync light for tune measurements
  - Uniform longitudinal emittance system
    - 4 GHz scope readout and analysis of data
  - Sync light

Some ideas for Collaboration - II

- SDA – shot data analysis – open ended
  - Write Java programs that can access both shot data and data logger data
  - Example - correlate beam position monitor data and beam loss monitor data with losses
- Many others – success comes from matching experimenter skills and interests with appropriate projects and BD contacts

Benefits of Help from Experimenters

- Contributes to improving integrated luminosity and more protons – Valuable skills
  - Detectors
  - Electronics
  - Programming
  - Analysis techniques
  - Not involved in day to day operations
  - Fresh perspective
- Better communications between BD and experiments
- Learn something new
  - From the project
  - Accelerator physics discussion group

But – they need recognition

- Experiments need people for own work
- Fermilab scientists can get internal recognition.
- How can university experimenters get "credit"
  - Counts for service work on D0/ CDF
  - DOE and NSF?
  - Published papers (from University of xyz)

Requirements for Successful Projects

- Open minded approach – from experimenters and BD people
  - "transplants" have a special role here
- Cultural differences
  - Operations vs. scientific inquiry
  - Have to fit into existing systems
- Learning curve – need sufficient commitment and initiative. Output appropriate for investment.
- Requires persistence– BD people are "interrupt driven" and expertise tends to be concentrated in a few people

Summary

- Many examples of successful experimenter contributions to BD
- Some cases which didn't work out
- The need exists
- Contact
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"Complex campaign of operations, maintenance, upgrades, R&D and studies"